IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Fernald et al.	§	Confirmation No.: 9757
Serial No.: 10/755,708	§	Group Art Unit: 2883
Filed: January 12, 2004	§	Examiner: James P. Hughes
For: LARGE DIAMETER OPTICAL WAVEGUIDE SPLICE	§	

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February 21, 2007
Date

Randol W. Read

Dear Sir:

APPEAL BRIEF

Applicants submit this Appeal Brief to the Board of Patent Appeals and Interferences on appeal from the decision of the Examiner of Group Art Unit 2883 dated September 22, 2006, finally rejecting claims 1-21 and 23-30. The final rejection of claims 1-12, 21 and 23-30 is appealed. This Appeal Brief is believed to be timely since it is facsimile transmitted by the due date of February 21, 2007, as set by the filing of a Notice of Appeal on December 21, 2006. Please charge the fee of $500.00 for filing this brief to Deposit Account No. 20-0782/WEAT/0553/RWR.

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Real Party in Interest

The present application has been assigned to Weatherford/Lamb, Inc., Houston, Texas.

Related Appeals and Interferences

Applicants assert that no other appeals or interferences are known to the Applicants, the Applicants' legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1-21 and 23-30 are pending in the application. Claims 1-30 were originally presented in the application. Claims 1-21 and 23-30 stand finally rejected as discussed below. The final rejections of claims 1-12, 21 and 23-30 are appealed. The pending claims are shown in the attached Claims Appendix.

Status of Amendments

All claim amendments have been entered by the Examiner. No amendments to the claims were proposed after the final rejection.

Summary of Claimed Subject Matter

Claimed embodiments of the invention provide techniques and systems that may be used to perform low-loss splicing of optical waveguide sections (see, *e.g.*, paragraph [0007] lines 1-2).

A. CLAIM 1 - INDEPENDENT

Claim 1 is directed to a method for splicing two optical waveguide sections, each having a core surrounded by a cladding, wherein at least one of the optical waveguide sections has an outer diameter greater than 400 micrometers (um) (see, *e.g.*, paragraph [0019] lines 1-10).

The method generally includes aligning respective cores at distal ends of the two optical waveguide sections (see, *e.g.*, paragraph [0024] lines 1-3, paragraph [0026] lines 2-9, paragraph [0030] lines 1-7, paragraph [0032] lines 1-14, and step 204 in FIG. 2) and fusing the distal ends of the optical waveguide sections by exposure to at least two separate laser beams (see, *e.g.*, paragraph [0023] lines 2-4, paragraph [0033] lines 1-8, paragraph [0034] lines 1-5, and FIGs. 6A-6C).

B. CLAIM 21 - INDEPENDENT

Claim 21 is directed to a system for fusing first and second optical waveguide sections together (see, *e.g.*, paragraph [0021] lines 1-2 and system 100 in FIG. 1), each optical waveguide section having a core surrounded by a cladding (see, *e.g.*, paragraph [0019] lines 1-11 as amended on page 2 in the Response to Final Office Action dated September 22, 2006, filed November 21, 2006).

The system generally includes at least one source laser to provide at least one laser beam (see, *e.g.*, paragraph [0023] lines 1-12 and source laser 110 and beams 115 in FIG. 1); first and second stages to hold the first and second optical waveguides (see, *e.g.*, paragraph [0022] lines 1-4 and stages 103, 105 and waveguide sections 102, 104 in FIG. 1), respectively, wherein at least one of the first and second stages is movable to provide relative motion between the first and second optical waveguides while

holding portions of the first and second optical waveguides to be fused within a fusion splice region while aligning their respective cores (see, *e.g.*, paragraph [0022] lines 4-7); and a beam delivery arrangement to deliver at least two laser beams to different locations of the fusion splice region, wherein the at least two laser beams are generated from the at least one laser beam provided by the at least one source (see, *e.g.*, paragraph [0023] lines 1-12 and lenses 136 and mirrors 131 in FIG. 1); wherein at least one of the stages is capable of holding an optical waveguide having a cross-sectional dimension greater than 400 um (see, *e.g.*, paragraph [0019] lines 1-10).

Grounds of Rejection to be Reviewed on Appeal

1. Claim 10 is rejected under 35 U.S.C. § 103(a) as being unpatentable over *Walters* (U.S. Pat. No. 6,033,515) in view of *Maas et al.* (U. S. Pat. No. 5,157,751, hereinafter, "*Maas*").

2. Claims 1-3, 6-7, 9, 12 and 23-25 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chapman et al.* (U.S. Pub. No. 2003/0223712, hereinafter, "*Chapman*") in view of *Maas*, in further view of *Walters*.

3. Claims 1, 4-5, 21 and 27-28 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chapman* in view of *Maas*, in further view of *Walters*, in further view of *Eskildsen et al.* (U.S. Pub. No. 2003/0108307, hereinafter, "*Eskildsen*").

4. Claims 1, 8, 10-11, 21, 26, and 29-30 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chapman* in view of *Maas*, in further view of *Walters*, in further view of *Huang et al.* (U.S. Pub. No. 2003/0117856, hereinafter, "*Huang*").

ARGUMENTS

Obviousness of Claim 10 over *Walters* in view of *Maas*

The Applicable Law

The Examiner bears the initial burden of establishing a *prima facie* case of obviousness. *See* MPEP § 2142. To establish a *prima facie* case of obviousness three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one ordinary skill in the art to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *See* MPEP § 2143.

Claim 10 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over *Walters* in view of *Mass*. Applicants respectfully traverse this rejection on the basis that the present rejection fails to establish at least the second and third criteria.

The References

Walters is directed to a method of fusion splicing optical components of substantially different cross-sectional areas (Abstract). The method generally includes aligning the two optical components along one axis; turning on a directional laser heat source to form a laser beam; directing the laser beam to be collinear with that optical component having a smaller cross-sectional area; ensuring that the laser beam strikes the surface of the optical component having the larger cross-sectional area at normal or near normal incidence so that absorption of the laser beam is much more efficient on the surface; adjusting the power level of the laser beam to form a softening region on the surface of the optical component having the larger cross-sectional area, thereby achieving the fusion-splicing; and turning off the laser (*Id.*).

Mass is directed to a protector for fiber optic splices, the method for making the protector, and the fixtures used with that method (col. 1 lines 7-9). The protected structure encapsulates two spliced optical fibers and includes a rigid tube surrounding the splice and its adjacent regions of the spliced fibers (Abstract). A plastic may be injected into the tube between the spliced fibers and the interior wall of the tube (*Id.*).

The Examiner's Argument

Regarding claim 10, the Examiner argues that *Walters* "teaches a method and apparatus for fusion splicing of an optical fiber (*e.g.*, a first waveguide section) and large optical device (*e.g.*, a second waveguide section), which has a much larger cross section than standard optical fibers. *Walters* teaches that the two optical [components] (*e.g.*, 16, and 14) are aligned along one axis and [employ] a split laser beam (*e.g.*, the two laser beams 10) with an adjusted power level for such fusion splicing [of] an optical fiber (14) to a large optical element (126) such as 'a lens, filter, grating, prism, WDM device, or other such optical component to which it is desired to secure the optical fiber 14' (Col. 6, ll. 20-22). (See *e.g.*, Col. 1, ll. 25-66, Col. 5, ll. 20 – Col. 6, ll. 25 and Fig. 1)" (page 3 of Examiner's Final Office Action mailed July 14, 2006; hereinafter "Examiner's Final Action").

However, the Examiner concedes that *Walters* "does not explicitly teach that the optical fiber (14) comprises a core and cladding and that the second waveguide section may not [necessarily] comprise an optical fiber" (*Id.*). The Examiner claims that "it would have been obvious to one of ordinary skill in the art at the time of the invention that the fiber in the invention of *Walters* may have a cladding. Similarly, it is notoriously well known in the art that it is common to align fiber cores during splicing – for example as taught by [*Maas*] in claim 4" (*Id.*).

Furthermore, the Examiner concedes that *Walters* "does not explicitly teach splicing two optical fibers. Rather *Walters* teaches a more general device that is capable of 'fusion splicing an optical fiber (14) to a large optical element (16) such as a 'lens, filter, grating, prism, WDM device, or other such optical component to which it is desired to secure the optical fiber 14' (Col. 6, ll. 20-22)" (pages 3 and 4 of Examiner's

Final Action). The Examiner claims that "it would have been obvious to one of ordinary skill in the art at the time of the invention to employ the invention of *Walters* to splice two optical fibers" (page 4 of Examiner's Final Action.).

Applicants' Response to the Examiner's Argument

Respectfully, Applicants submit that the present rejection fails to establish a teaching or suggestion of all claim elements in support of a *prima facie* case of obviousness. For example, *Walters* in view of *Mass* does not teach, show, or suggest a "method for splicing two optical waveguide sections, *each having a core surrounded by a cladding*, wherein at least one of the optical waveguide sections has an outer diameter greater than 400 micrometers (um), comprising...*fusing the distal ends* of the optical waveguide sections by exposure to at least two separate laser beams" as recited in independent claim 1. *Walters* only teaches fusion splicing a "single mode optical fiber directly to a collimating lens, a filter, a grating, a prism, a wavelength division multiplexer (WDM) device, or any other optical component of comparatively larger cross-sectional area" (col. 2 lines 24-30). Applicants respectfully submit that such devices as a lens or a prism do not have distal ends.

Furthermore, Applicants submit that the present rejection fails to establish a reasonable expectation of success according to the second criterion for a *prima facie* case of obviousness. For example, the combination of *Walters* in view of *Mass* would not reasonably lead to low optical loss splicing of "two optical waveguide sections, each having a core surrounded by a cladding, wherein at least one of the optical waveguide sections has an outer diameter greater than 400" μm as recited in claim 1. Neither *Walters* nor *Mass* teach aligning the cores of two large diameter waveguides, much less aligning said cores to achieve a low loss optical splice.

Rather, *Walters* teaches splicing of an optical fiber to a component, such as a lens, that does not have a core to guide the light, and thus, aligning the waveguide cores is not a problem for *Walters.* According to paragraph [0005] of the present application, conventional techniques for fusion splicing of optical fiber "are typically limited to fiber diameters of 400 um or less. Modifying devices utilizing these

[conventional] techniques to accommodate larger diameters optical waveguides (*e.g.*, of a large diameter carrier and device that may be greater than 1 mm) would present a challenge and may not be feasible, particularly when trying to maintain uniform heating around the entire diameter of the splice area to achieve a strong splice, while also maintaining alignment of the narrow (*e.g.*, 5 um diameter) fiber cores to minimize optical loss through the splice region."

Mass fails to overcome the deficiencies in *Walters*. For example, *Mass* does not teach, show, or suggest a method for splicing two optical waveguide sections and, more specifically, "fusing the distal ends of the optical waveguide sections by exposure to at least two separate laser beams" as recited in independent claim 1. The cited section of *Mass* only teaches "an end of each said optical core being...fusion spliced together" (claim 4).

Accordingly, Applicants submit that claim 1, as well as claim 10 dependent therefrom, is allowable. Withdrawal of the rejection is respectfully requested.

Obviousness of Claims 1-3, 6-7, 9, 12, and 23-25 over *Chapman* in view of *Maas*, in further view of *Walters*

The References

Chapman is directed to a method and apparatus for splicing optical fibers (paragraph [0002] lines 1-2). The splicing apparatus "includes a clamp for retaining a first optical fiber and a second optical fiber within the splicing apparatus; and at least one laser" (paragraph [0010] lines 1-5). "The at least one laser is adapted to emit a first laser beam for stripping a coating from about the first and second optical fibers while the first and second optical fibers are retained by the clamp, a second laser beam for cleaving an end of the first optical fiber and an end of the second optical fiber while the first and second optical fibers are retained by the clamp, and a third laser beam for splicing the ends of the optical fibers together creating a fused connection therebetween while the first and second optical fibers are retained by the clamp" (paragraph [0010] lines 5-14). The method generally involves securing the first and second optical fibers to be fused within the apparatus; using the first, second, and third laser beams to strip

the coating, to cleave ends of the fibers, and to fusion splice the ends together, respectively; and removing the fused optical fibers from the apparatus (paragraph [0008]).

Mass and *Walters* have already been described above.

The Examiner's Argument

Regarding claims 1-3, 6-7, 9, 12 and 23-25, the Examiner argues that *Chapman* in view of *Mass* "teaches a method and apparatus for splicing two optical fibers as discussed above" (page 5 of Examiner's Final Action). However, the Examiner concedes that *Chapman* "does not explicitly teach that at least one of the fibers has a diameter greater than 400 micrometers" (*Id.*). Therefore, the Examiner argues that *Walters* in view of *Mass* "teaches fusion splicing of fibers and large optical devices, which have a much larger cross section than standard optical fibers as discussed above" (*Id.*).

The Examiner continues to argue that *Chapman* "teaches employing two laser sources for preparing an optical fiber for fusion splicing is advantageous because it allows a high reliability and control of the heat source (see *e.g.*, p. 25)" (*Id.*). The Examiner claims that it would have been obvious "to employ two beams to connect optical components – such as those with a 400 um and [greater] diameter – to each other as is taught by Walters in the method and device of Chapman to splice two larger (*e.g.*, multimode) fibers or a single mode to a multimode fiber – *e.g.*, optical waveguide sections with different and/or large cross-section diameters" (*Id.*).

Applicants' Response to the Examiner's Argument

Respectfully, Applicants submit that the present rejection fails to establish a reasonable expectation of success according to the second criterion for a *prima facie* case of obviousness. For example, the combination of *Chapman* in view of *Mass*, in further view of *Walters* would not reasonably lead to low optical loss splicing of two optical waveguide sections, each having a core and a cladding, wherein at least one of the optical waveguide sections has a large diameter. According to paragraph [0005] of

the present application, conventional techniques for fusion splicing of optical fiber "are typically limited to fiber diameters of 400 um or less. Modifying devices utilizing these [conventional] techniques to accommodate larger diameters optical waveguides (*e.g.*, of a large diameter carrier and device that may be greater than 1 mm) would present a challenge and may not be feasible, particularly when trying to maintain uniform heating around the entire diameter of the splice area to achieve a strong splice, while also maintaining alignment of the narrow (*e.g.*, 5 um diameter) fiber cores to minimize optical loss through the splice region."

As conceded by the Examiner, *Chapman* "does not explicitly teach that at least one of the fibers has a diameter greater than 400 micrometers" (page 5 of the Examiner's Final Action), and neither does *Mass. Walters* teaches fusion splicing of two optical components (*e.g.*, an optical fiber and a lens) having significantly different cross-sectional areas by grazing of the optical fiber with the laser beam, which is directed along the axis of the fiber, such that "the laser beam strikes the larger cross-sectional area optical element at normal or near normal incidence so that absorptions of the laser is much more efficient on the larger surface" (col. 5 lines 17-20 and 58-61). Such a laser grazing technique may not reasonably succeed in uniformly heating the splice area of "two optical waveguide sections, each having a core and a cladding, wherein at least one of the optical waveguide sections has an outer diameter greater than 400 micrometers (um)" as recited in independent claim 1.

Furthermore, Applicants respectfully submit that the present rejection fails to establish a teaching or suggestion of all claim elements in support of a *prima facie* case of obviousness according to the third criterion. For example, *Chapman* in view of *Mass,* further in view of *Walters* does not teach, show, or suggest a "method for splicing two optical waveguide sections, each having a core surrounded by a cladding, wherein at least one of the optical waveguide sections has *an outer diameter greater than 400 micrometers (um)*" as recited in independent claim 1.

As another example of failing to establish a teaching or suggestion of all claim elements in support of a *prima facie* case of obviousness, *Chapman* in view of *Mass,* further in view of *Walters* does not teach, show, or suggest a "system for fusing first and

second optical waveguide sections together, each optical waveguide section having a core surrounded by a cladding, comprising...first and second stages to hold the first and second optical waveguides, respectively, wherein *at least one of the first and second stages is movable to provide relative motion between the first and second optical waveguides* while holding portions of the first and second optical waveguides to be fused with a fusion splice region while aligning their respective cores; and...wherein at least one of the stages is capable of holding *an optical waveguide having a cross-sectional dimension greater than 400 um*" as recited in independent claim 21.

Rather, *Chapman* teaches a clamp assembly 28 with a movable stage 30 that "moves with the clamped optical fibers 12 and 14 in alignment under [stationary] laser beams 19 and 26" (paragraph [0017] lines 1-9). Between the holder 32, the positioning arms 54 and 56, the clamping arms 74 and 76, and the secondary clamps 68 and 70, none are described as movable to provide relative motion between the optical fibers 12 and 14 (paragraph [0017] lines 9-10 and 23-39). Instead, *Chapman* teaches that the holder 32, the positioning arms 54 and 56, the clamping arms 74 and 76, and the secondary clamps 68 and 70 simply form a holding, gripping, or clamping function on the optical fibers 12 and 14 as the single stage 30 is moved relative to the laser beams 19 and 26 (paragraph [0017]). Furthermore, none of the elements of the clamp assembly 28 are capable of holding an optical waveguide having a cross-sectional dimension greater than 400 um. *Mass* and *Walters* are silent as to a system for fusing optical waveguides and any stages for holding the optical waveguides, and thus, do not overcome the deficiencies of *Chapman*.

Accordingly, Applicants submit that claims 1 and 21, as well as claims dependent therefrom, are allowable. Withdrawal of the rejection is respectfully requested.

Obviousness of Claims 4-5, 21, and 27-28 over *Chapman* in view of *Maas*, in further view of *Walters*, in further view of *Eskildsen*

The References

Chapman, Mass, and *Walters* have already been described above.

Eskildsen is directed to an optical attenuator and a method of making an optical attenuator (paragraph [0006] lines 1-3). The optical attenuator is provided "using a fusion splice whose attenuation can be more precisely controlled than in conventional fusion splice optical attenuators" (paragraph [0011] lines 1-4).

The Examiner's Argument

Regarding claims 4-5, 21, and 27-28, the Examiner argues that *Chapman* in view of *Mass*, in further view of *Walters*, "teaches a method and apparatus for fusion splicing optical fibers as discussed above" (page 6 of Examiner's Final Action). In addition, the Examiner argues that *Eskildsen* "teaches an apparatus and method for aligning two fibers for fusion splicing and subsequently evaluating the loss of the resulting splice. *Eskildsen* teaches that a power monitoring may be accomplished automatically by transmitting optical power through the fibers and detecting the power after traversing the fusion splice. Following the detected power may be used as a feedback signal to adjust the lateral position of the fibers (See *e.g.*, p. 13). *Eskildsen* also teaches that the loss of the resulting spliced fiber may be measured via similar methods. (See *e.g.*, p. 16)" (*Id.*).

However, the Examiner concedes that "*Chapman* in view of *Walters* in view of *Eskildsen* does not explicitly teach splicing fibers with reflective gratings," but claims that "such fibers are commonly used in the art and could be incorporated in these inventions" (*Id.*). The Examiner also concedes that *Chapman* in view of *Walters* "does not explicitly teach detecting light passing through a spliced region or the specific signal processing employed," but claims that "it would have been obvious to one of ordinary skill in the art at the time of the invention to employ alignment and analysis systems and methods as taught by *Eskildsen* in the invention [of] *Chapman* in view of *Walters*" (*Id.*).

Applicants' Response to the Examiner's Argument

Applicants believe that *Chapman* in view of *Mass*, in further view of *Walters* as applied to claims 1-3, 6-7, 9, 12, and 23-25 has been overcome. Specifically, Applicants believe that *Chapman* in view of *Mass*, in further view of *Walters* does not teach each element of the base claims according to the third criterion for the reasons given above. Therefore, a *prima facie* case of obviousness has not been established.

Eskildsen does not overcome the deficiencies in *Chapman* in view of *Mass*, in further view of *Walters*. Therefore, Applicants submit that claims 1, 4-5, 21 and 27-28 are patentable over *Chapman* in view of *Maas*, in further view of *Walters*, in further view of *Eskildsen*. Withdrawal of the rejection is respectfully requested.

Obviousness of Claims 8, 10-11, 21, 26, and 29-30 over *Chapman* in view of *Maas*, in further view of *Walters*, in further view of *Huang*

The References

Chapman, Mass, and *Walters* have already been described above.

Huang is directed to a method and apparatus for fusion splicing optical fibers using laser light (paragraph [0009] line 1 to paragraph [0010] line 3). The heat absorption of the fibers is higher and the variation of the absorption for small deviations of the wavelength is smaller than with conventional methods (Abstract). As a result, less laser power is needed, the laser construction may be more compact, and safety problems can be more easily handled (*Id.*).

The Examiner's Argument

Regarding claims 8, 10-11, 21, 26, and 29-30, the Examiner argues that *Chapman* in view of *Mass*, in further view of *Walters* "teaches a method and apparatus for fusion splicing optical fibers as discussed above" (page 7 of Examiner's Final Action). Moreover, the Examiner argues that *Huang* "teaches an apparatus and method of splicing optical fibers wherein mechanical and electrical shutters may control the exposure of laser light to a fusion splice region. *Huang* additionally teaches that a laser may be applied to the fibers so that the fiber ends become soft and are slightly deformed – thus forming a curvature... (See *e.g.*, p. 28-37) *Huang* additionally teaches that visible laser beams may be employed in alignment of fibers in fusion splicing. (See *e.g.*, p. 8)" (*Id.*).

However, the Examiner concedes that *Chapman* in view of *Walters* "does not explicitly teach employing a shutter device to control the laser," but claims that "it would have been obvious...to employ a shutter device because shutter device[s] are

commonly used in the laser art to control laser beams as, for example, taught by *Huang* in the invention of Chapman in view of Walters" (*Id.*). In addition, the Examiner concedes that *Chapman* in view of *Walters* "does not explicitly teach applying a laser to the fibers to provide a curvature to their distal ends," but claims that "it would have been obvious…to incorporate the splicing techniques such as applying a laser to the fibers thus providing a curvature to their distal ends" (pages 7-8 of Examiner's Final Action). The Examiner also concedes that *Chapman* in view of *Walters* "does not explicitly teach employing a visible laser beam during alignment of the fiber splice," but claims that "it would have been obvious…to incorporate an alignment system as taught by *Huang*, including splitting the visible beam," in the invention of *Chapman* in view of *Walters* (*Id.*). Furthermore, the Examiner concedes that *Chapman* in view of *Walters* "does not explicitly teach employing a lathe in the fusion process, but claims that it "would have obvious…to incorporate a lathe for rotating the fibers" in the invention of *Chapman* in view of *Walters* (*Id.*).

Applicants' Response to the Examiner's Argument

Applicants believe that *Chapman* in view of *Mass*, in further view of *Walters* as applied to claims 1-3, 6-7, 9, 12, and 23-25 has been overcome. Specifically, Applicants believe that *Chapman* in view of *Mass*, in further view of *Walters* does not teach each element of the base claims, for the reasons given above. Therefore, a *prima facie* case of obviousness has not been established. *Huang* does not overcome the deficiencies in *Chapman* in view of *Mass*, in further view of *Walters*. Therefore, Applicants submit that claims 8, 10-11, 21, 26 and 29-30 are patentable over *Chapman* in view of *Maas*, in further view of *Walters*, in further view of *Huang*. Withdrawal of the rejection is respectfully requested.

CONCLUSION

The Examiner errs in finding that claim 10 is rejected under 35 U.S.C. § 103(a) as being unpatentable over *Walters* in view of *Maas*. The Examiner errs in finding that claims 1-3, 6-7, 9, 12 and 23-25 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chapman* in view of *Maas*, in further view of *Walters*. The Examiner errs in finding that claims 4-5, 21 and 27-28 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chapman* in view of *Maas*, in further view of *Walters*, in further view of *Eskildsen*. The Examiner errs in finding that claims 8, 10-11, 21, 26 and 29-30 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chapman* in view of *Maas*, in further view of *Walters*, in further view of *Huang*. Withdrawal of these rejections and allowance of all claims is respectfully requested.

Respectfully submitted,

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CLAIMS APPENDIX

1. (Previously Presented) A method for splicing two optical waveguide sections, each having a core surrounded by a cladding, wherein at least one of the optical waveguide sections has an outer diameter greater than 400 micrometers (um), comprising:

aligning respective cores at distal ends of the two optical waveguide sections; and

fusing the distal ends of the optical waveguide sections by exposure to at least two separate laser beams.

2. (Original) The method of claim 1, wherein the two optical waveguide sections have at least one different cross-sectional dimension.

3. (Original) The method of claim 1, further comprising moving the distal ends of the optical waveguide sections relative to each other during the fusing.

4. (Original) The method of claim 1, wherein aligning the distal ends of the optical waveguide sections comprises:

taking a measurement of optical power transmitted through a coupling of the distal ends of the optical waveguide sections.

5. (Original) The method of claim 4, wherein taking a measurement of optical power transmitted through the coupling of the distal ends of the optical waveguide sections comprises:

transmitting light through one of the optical waveguide sections; and

measuring the optical power of light reflected from one or more gratings in the other optical waveguide section.

6. (Original) The method of claim 1, further comprising generating the at least two separate laser beams from a single laser beam.

7. (Original) The method of claim 1, wherein fusing the distal ends of the optical waveguide sections comprises varying the power of the at least two separate laser beams during the fusing.

8. (Original) The method of claim 1, wherein fusing the distal ends of the optical waveguide sections comprises operating a shutter device to intermittently expose the distal ends to the at least two separate laser beams.

9. (Original) The method of claim 1, wherein moving the distal ends of the optical waveguide relative to each other during the fusing comprises:

moving at least one distal end closer to the other distal end during one portion of the fusing; and

moving the at least one distal end away from the other distal end during another portion of the fusing.

10. (Original) The method of claim 1, further comprising polishing the distal ends of the optical waveguide sections prior to the fusing by:

setting the power of the at least two separate laser beams to a level lower than that used during the fusing; and

exposing the distal ends to the at least two separate laser beams at the lower power level.

11. (Original) The method of claim 1, further comprising providing a curvature on the distal ends of the optical waveguide sections.

12. (Original) The method of claim 1, wherein dimensions of the at least two separate laser beams are selected to provide uniform heating to distal ends of optical waveguide sections having outer diameters greater than 400um.

13. (Previously Presented) A method for splicing together two optical waveguide sections, each having a core surrounded by a cladding, comprising:

a) aligning respective cores at distal ends of the two optical waveguide sections;

b) providing at least two laser beams for heating the optical waveguide sections;

c) adjusting a power level of the at least two laser beams; and

d) exposing the distal ends of the optical waveguide sections to the at least two laser beams.

14. (Original) The method of claim 13, wherein a cross-sectional dimension of at least one of the optical waveguide sections is greater than 400um.

15. (Original) The method of claim 13, wherein the two optical waveguide sections have different cross-sectional dimensions.

16. (Original) The method of claim 13, further comprising repeating steps c) and d) until the distal ends are fully fused.

17. (Original) The method of claim 16, further comprising determining the distal ends are fully fused by monitoring a heat zone including coupled portions of the two distal ends.

18. (Original) The method of claim 13, wherein providing at least two laser beams for heating the optical waveguide sections comprises splitting a beam from a single source laser.

19. (Original) The method of claim 13, wherein exposing the distal ends of the optical waveguide sections to the at least two laser beams comprises operating a shutter device.

20. (Original) The method of claim 13, further comprising taking a measurement of optical power through the distal ends for use in calculating optical loss therethrough.

21. (Previously Presented) A system for fusing first and second optical waveguide sections together, each optical waveguide section having a core surrounded by a cladding, comprising:

at least one source laser to provide at least one laser beam;

first and second stages to hold the first and second optical waveguides, respectively, wherein at least one of the first and second stages is movable to provide relative motion between the first and second optical waveguides while holding portions

of the first and second optical waveguides to be fused within a fusion splice region while aligning their respective cores; and

a beam delivery arrangement to deliver at least two laser beams to different locations of the fusion splice region, wherein the at least two laser beams are generated from the at least one laser beam provided by the at least one source;

wherein at least one of the stages is capable of holding an optical waveguide having a cross-sectional dimension greater than 400 um.

22. (Canceled)

23. (Original) The system of claim 21, wherein the first and second stages are capable of holding first and second optical waveguides having different cross-sectional dimensions.

24. (Original) The system of claim 21, wherein the at least one source laser comprises at least two source lasers.

25. (Original) The system of claim 21, wherein the beam delivery arrangement comprises at least one beam splitter to generate the at least two laser beams from a single laser beam provided by the source laser.

26. (Original) The system of claim 21, wherein at least one of the first and second stages is coupled with a lathe capable of providing rotational motion thereto.

27. (Original) The system of claim 21, further comprising:

a light source for transmitting light through the first optical waveguide section to the second optical waveguide section;

a detector coupled with the second optical waveguide section; and

optical signal processing for measuring a difference in the light transmitted through the first optical waveguide section and the light detected by the detector.

28. (Original) The system of claim 21, further comprising:

a light source for transmitting light through the first optical waveguide section to the second optical waveguide section;

one or more reflective gratings formed in an optical waveguide coupled with the second optical waveguide section; and

optical signal processing for measuring light transmitted from the light source and reflected from the one or more reflective gratings.

29. (Original) The system of claim 21, further comprising a reference laser to provide a visible reference laser beam for use in aligning the first and second optical waveguide sections in the fusion splice region.

30. (Original) The system of claim 29, wherein at least a portion of the beam delivery arrangement splits the visible reference laser beam into at least two visible reference laser beams delivered to different locations of the fusion splice region.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.